Short Paper

# Security in Affordable Housing Project in Saudi Arabia

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**Abstract**
*The Saudi society used to be among the most secure in the world. Unfortunately, recent statistics have indicated an increase in crime rates that may be attributed to a number of socio economic and cultural factors. A number of affordable housing schemes based on western design traditions were built that did not create the expected level of security to its residents. Prince Abdul Majeed housing scheme represent an outstanding example, as statistics indicated that the project has 17 times more crime than the average of the city of Jeddah, where the project is located. Faced with lack of spatial crime data, trace observation and questionnaire were utilized to acquire qualitative and quantitative crime data based on residence location within the project for a representative sample of project residents. The project layout was analyzed using Depthmap. The results indicated the 15% of the respondents had experienced one or more crimes. Spatial and syntactic characteristics for different crime types were identified. Explanation was given for the high crime rates within the project, among which are high degree of permeability, uncontrollable spaces, and weak connectivity with the surrounding.*

## 1. Background

Saudi Arabia used to be one of the safest countries in the world. Unfortunately, recent statistics indicated that crime rates are increasing as a result of socio economic and cultural changes. Moreover, the mounting demand for housing, led to the erection of a number of the so called affordable housing schemes that follow western design traditions that are unfamiliar to the Saudi society. Statistics indicated that such schemes are among the most unsafe in the Kingdom. Prince Abdul Majeed housing scheme represent an outstanding example, as the project has a rate of 14.66 crimes per 1000 inhabitants, as opposed to 0.5 crime per 1000 for the city of Jeddah, where the project is located. This paper attempts to identify urban spatial characteristics that contributed to such an outcome.

## 2. Study Methodology

A sample of 349 families filled out the questionnaire. It involved questions about fear of crime and actual crime. Visibility graph analysis of the project's site was performed using Depthmap 7.12.00d. For every building in the sample, means for all measures were computed for the space right adjacent to buildings' entrances (every building had two entrances). Respondent residence location (building) instead of actual crime location was used as a base for the analysis, as spatial crime statistics were not available, moreover, respondents were unable to pinpoint exact crime location. Findings are limited to certain crime types with adequate incidents.

## 3. Review of literature

The factors that contribute to crime in residential environments are the subject of furious debate between two schools of thought; each has its own view on how to attain safer built environments: the defensible space school and the new urbanism school.

Defensible space school had its roots in the territoriality theory. It was Oscar Newman who developed practical design guidelines to help design safer residential environments (Newman, 1972). He adopted a strategy that favored enclosed private space with limited access to strangers to create a sense of community and to reduce number of strangers. He favored separation of uses to maximize residents' control of their environment, and called for eliminating alleys, yet favored low density environments.

The new urbanism proponents recommended the opposite. They called for high density permeable environments and grid street pattern to encourage accessibility and increase encounter opportunities to create what Hillier termed "virtual community". They called for mixed use to increase activity and presence of people, as well as locating buildings near the street orienting them toward it to foster natural surveillance.

Hillier investigated these contradictory recommendations, and concluded that flats are generally the safest among building types, and that ground level density reduces risk of crime while off the ground density may increase it. He favored linear arrangement of relatively large residential blocks on two sides of the street, and advocated local movement versus larger scale movement. Contrary to his previous claims, Hillier discovered no significant differences between cul de sacs and gridiron layouts as long as there are a good number of dwellings on the street segment to reduce the risk of burglary, and he advocated mixed use. He claimed that residential areas should be permeable enough to allow for movement in all directions, yet the over-provision of poorly used permeability might constitute a crime hazard (Hillier & Sahbaz, 2008). He supported defensible space stand regarding the dangers of rear and courtyard parking, as well as on the risks introduced by footpaths and alleys (Hillier & Shu 2000, Hillier 2004).

## 4. Project description

The project lies in the city of Jeddah, Saudi Arabia near a highway (Figure 1). The project's site is relatively isolated, surrounded by vacant land from all sides and only connected to the rest of the city from north, with a secondary weak connection from the south, No connections existed from east and west, which contributed to the project isolation. The project consisted of 9 squared typical residential blocks and a half block, each is 270 by 270 meters. The blocks are surrounded by quite wide streets that form a perfect grid. Each block has 20 apartment buildings ranging from 7 to 3 stories. Each block has a large central space, divided into two smaller spaces by the communal facilities and a mosque. Those spaces were designed as parking lots. Each block has four one story parking buildings, the floor of which is half floor below ground, yet the roof is half floor above ground designed as a communal space and playground. Every building had two entrances, a main entrance accessible from the inner spaces and secondary one accessible from main streets.

Buildings form small clusters, overlooking the parking building roof and the surrounding streets, yet some buildings were part of a large cluster that overlooks group's central space. Groups are quite permeable and accessible from all directions with 18 entry points. Integration map (Figure 2) revealed a spatial hierarchy, as group interior is less integrated that the surrounding streets. Within the same group, the central space is more integrated than off the middle spaces

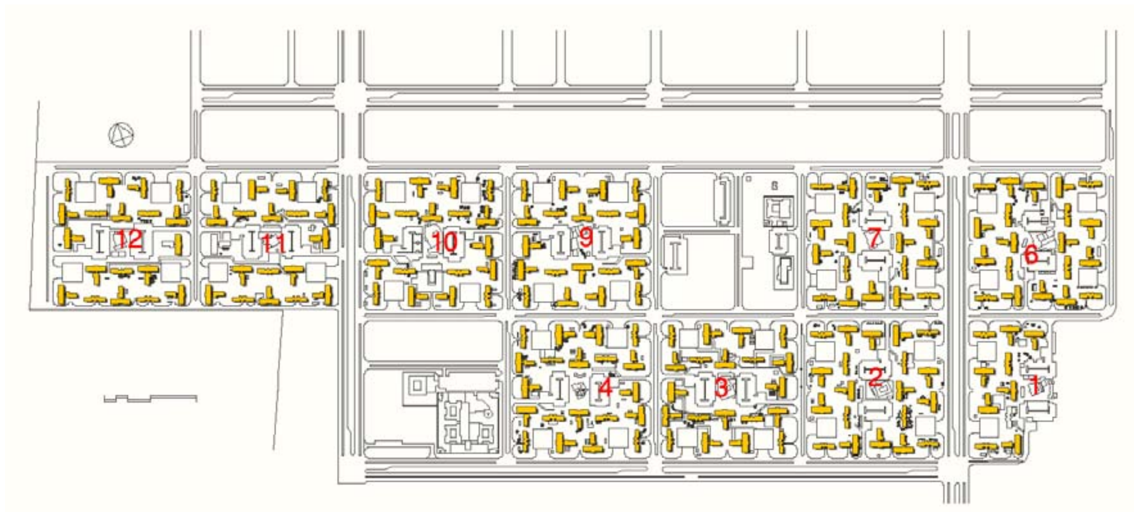


***Figure 1***
*King Abdul Majeed Housing Scheme Showing 10 residential groups*

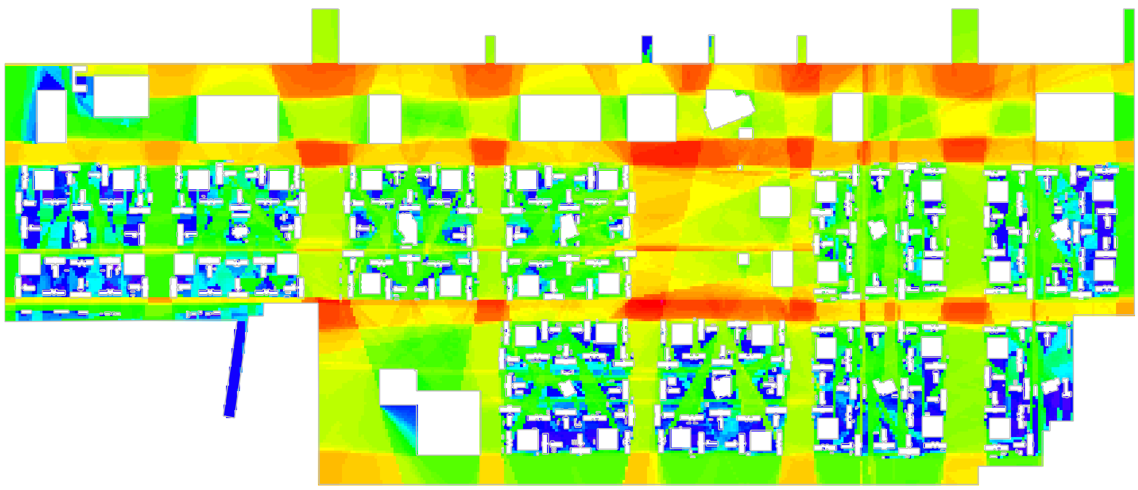

***Figure 2***
*Visual integration map of the projects' site*

## 5. Findings

The integration graph revealed some differences as to groups integration values despite that group layouts are almost identical based on group's relative location within the layout. Groups 7 & 9 in the middle had the highest integration values (m=7.6, 7.4 respectively) followed by groups 2, 3, 4 that are adjacent to the southern edge (m= 6.85, 7.15, 6.7 respectively), and finally groups 1, 6, 12 that are adjacent to eastern and western edge (m= 6.5, 6.7, 6.4 respectively). It also revealed that the northern edge is more integrated than other project edges.

### 5.1. Site design and crime

The project's high crime rates may be attributed to following spatial properties: The relative isolation of the project from the surrounding works in favor of crime committers, as the surrounding has many informal entry and exit points that are used by crime committers, giving them more accessibility to the project than project residents and even the police. The answer to this problem is to better connect the project to its surrounding to improve accessibility for residents and police.

The high degree of internal permeability reduces residents control over their space and makes it easier for criminals to commit a crime and withdraw promptly, which is in line with Hillier's' view regarding the effect of permeability. The overly wide project streets significantly decrease the ability for street surveillance and reduce the relation between buildings on both sides of the street. Parking lot roofs were not used as planned, as traces of misuse and vandalism indicates a security hitch. This may be attributed to the difficulty of surveillance from the ground level, as well as its weak connectivity with ground floor.

The group central space is the safest in the group. Although initially designed as a parking space, kids use it for playing and casual social gatherings instead of parking roof. Its location in the middle made it the most integrated in the group, it is under the surveillance of surrounding apartments, and because the mosque and shops opens into that space. This support the call for mixed use by safescape and Hillier. Having two entrances for every building weakens control over illegal access to the building.

**5.2. Spatial properties of crime**

Crime rates differed for different groups. When the group's crime rates line (in red) was superimposed on lines representing mean standardized visibility graph measures for group's front and back spaces the outcome was surprising, as crime rates curve closely matches that of mean depth, relative entropy, compactness, and clustering coefficient (in grey), and it was almost the inverted shape of the measures integration, connectivity, isovist area and perimeter (in yellow).

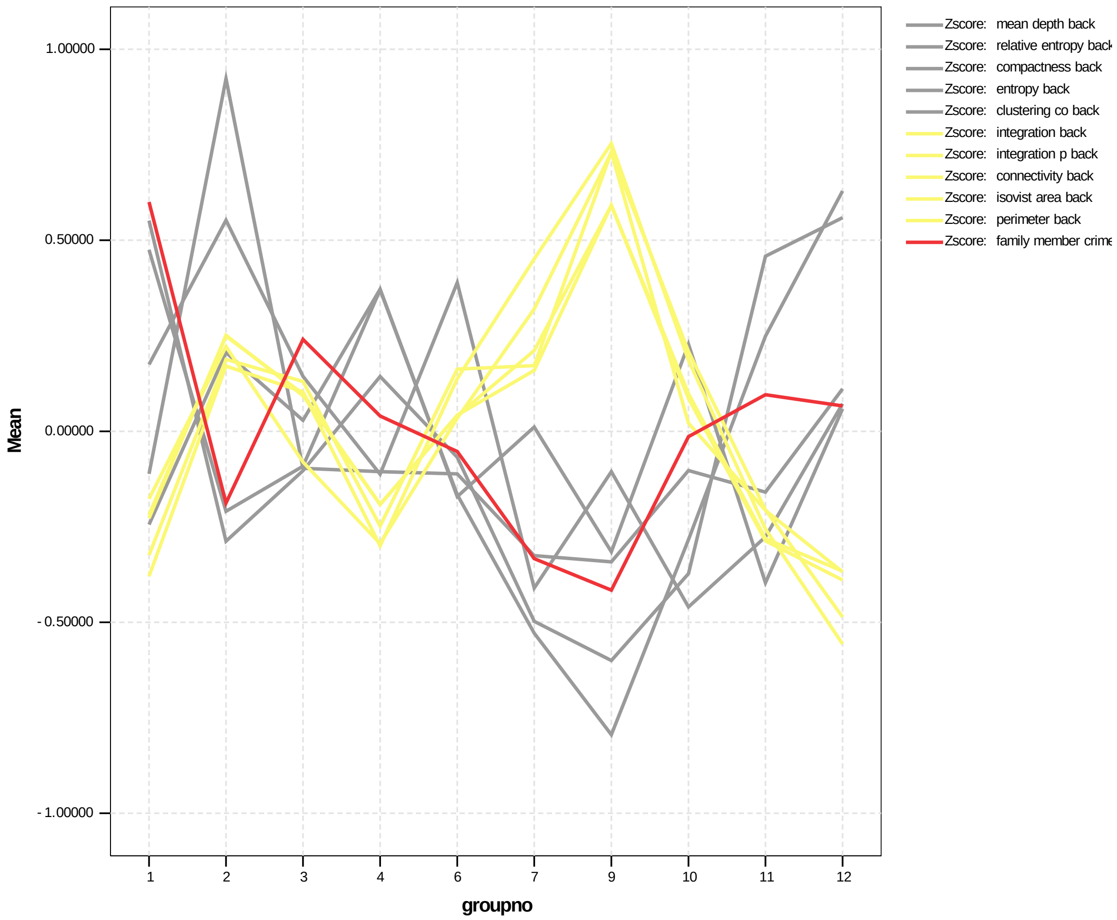


***Figure 3***

*Standardized crime rates for different groups superimposed over standardized visibility graph measures.*

It may be said that crime rates tend to increase in groups that have higher values of mean depth, relative entropy, compactness, and clustering coefficient, yet having lower values for integration, connectivity, isovist area and perimeter, and vise versa.

5.2.1. Crime types

Respondents encountered several crime types in the project. Theft constitutes the majority (31%), followed by car theft (26%), fights (13%), theft from car (11%), car vandalism (9%), sexual harassment (6%), and finally abduction (4%). Crimes with incidences less that 10% were not investigated. For the remaining crime types, spatial properties were compared for different crime types with no crime locations. Analysis of variance found no significant differences for theft crime. Differences were found for car theft and theft from cars.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | car theft | 12 | 25.5 | 25.5 | 25.5 |
| | car vandal | 4 | 8.5 | 8.5 | 34.0 |
| | theft from car | 5 | 10.6 | 10.6 | 44.7 |
| | theft | 15 | 31.9 | 31.9 | 76.6 |
| | Sexual Harassment | 3 | 6.4 | 6.4 | 83.0 |
| | abduction | 2 | 4.3 | 4.3 | 87.2 |
| | fights | 6 | 12.8 | 12.8 | 100.0 |
| | Total | 47 | 100.0 | 100.0 | |

***Table 1***

*Crime type rates*

| | family member crime type | | | |
|---|---|---|---|---|
| | **No theft** | **Car theft** | **Total** | **Sig.** |
| Connectivity Back | 1586.78 | 362.40 | 1540.58 | .008 |
| isovist area | 10603.27 | 6756.00 | 10458.09 | .039 |
| isovist area back | 39276.58 | 8943.40 | 38131.93 | .008 |
| compactness back | .0748 | .1358 | .0771 | .011 |
| magnitude back | 147.39 | 53.78 | 143.85 | .027 |
| occlusivity | 978.15 | 723.00 | 968.52 | .032 |
| occlusivity back | 2016.57 | 778.60 | 1969.86 | .001 |
| perimeter | 1325.46 | 1026.50 | 1314.18 | .028 |
| perimeter back | 2823.29 | 1170.10 | 2760.91 | .001 |
| first moment back | 530560.10 | 37602.30 | 511957.92 | .018 |
| integration back | 7.79966 | 6.24000 | 7.74080 | .000 |
| integration p back | .5996 | .4820 | .5951 | .001 |
| integration t | .4703 | .4783 | .4706 | .000 |
| mean depth back | 2.7209 | 3.0962 | 2.7350 | .000 |
| relative entropy | 2.8088 | 2.9139 | 2.8128 | .004 |
| relative entropy back | 2.6423 | 2.9129 | 2.6525 | .000 |

***Table 2***

*Significantly different mean visibility graph measure's values for residence locations that had car theft and those who had none*

Spatial and statistical analysis revealed that mean integration value for residence location of respondents that experience car theft was significantly lower (m=6.24) than that of no theft buildings (m=7.8), meaning that car theft tend to take place in quieter locations within the project. Figure 4 represents probable high risk locations for car theft crime calculated based on mean integration value for the crime type ± 1 standard deviation).

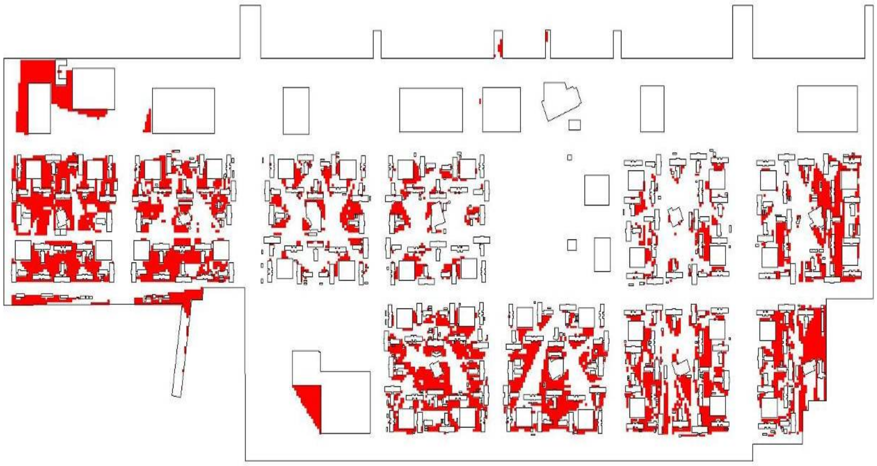

***Figure 4***
*Probable high risk locations of car theft (top), Probable high risk locations of theft from cars (bottom) (mean integration ± 1 standard deviation)*

Discriminant analysis is used to develop a function that would help classify points as either high risk points with respect to car theft or not based on values of a subset of the variables. The analysis produced Fisher's linear discriminant functions, one for low risk and the other for the high risk. The functions are:

D(LOW) = -3243.146 + controllability × 1181.161 + integration t × 11532.053 + relative entropy × 367.326

D(HIGH) = -3403.538+ controllability × 1221.441+ integration t × 11769.249+ relative entropy × 383.670

The functions correctly classified 91.3 of the cases for the whole sample, yet it correctly classified 45.5% of the high risk cases.

As for theft from cars, analysis revealed that it also has identifiable spatial properties compared to no theft locations (Table 3). Mean integration value for theft from car locations was (9.56) as opposed to (7.8) for no theft locations. This indicated that this type of crime tend to take place in more integrated spaces of the project, mainly project main streets. Figure 4 represents probable high risk locations for theft from car crime calculated based on mean integration value for the crime type ± 1 standard deviation).

| | family member crime type | | | |
|---|---|---|---|---|
| | no | theft from car | Total | Sig. |
| Connectivity back | 1586.78 | 3369.33 | 1607.51 | .034 |
| isovist area back | 39276.58 | 83872.67 | 39795.14 | .033 |
| occlusivity back | 2016.57 | 3458.67 | 2033.34 | .036 |
| perimeter back | 2823.29 | 4717.33 | 2845.31 | .038 |
| first moment back | 530560.10 | 1413456.00 | 540826.33 | .021 |
| integration back | 7.79966 | 9.56100 | 7.82014 | .023 |
| integration p back | .5996 | .7393 | .6012 | .034 |
| mean depth back | 2.7209 | 2.3883 | 2.7170 | .039 |

***Table 3***
*Significantly different mean visibility graph measure's values for residence locations that had theft from cars and those who had none*

Discriminant analysis did not produce reliable results as the number of instances for the theft from cars crime is too small.

## 6. Conclusion

The high crime rates that the project has may be attributed to project's design. Weak connectivity with the surroundings, excessive permeability, the overly wide project streets, roof of parking buildings, and having two entrances to every building together contributed to the high crime rates compared to the average for Saudi Arabia. Correspondence between people's intuitive fear of crime from certain locations and actual crime rates was not supported by this study. This study found that in general, crime rates tend to increase in segregated groups. Car theft tends to take place in segregated locations of the project, whereas theft from cars tends to favors highly integrated project's spaces and streets. Findings from this study are in line with safescape and Hillier's findings more than with defensible space.

## Note

This paper is based on partial results of a research project titled "Practical Urban Design Guidelines for enhancing safety and security of Saudi affordable housing projects utilizing space syntax" 2008, funded by a research grant from Al-Saedan Chair on Affordable Housing, King Fahd University for Petroleum and Minerals.

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